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February 27-March 6, 2013

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

A meeting of the Newfoundland and Labrador (NL) regional advisory process (RAP) on Snow Crab and whelk was held February 27-March 6, 2013 in St. John's, Newfoundland. Its purpose was to assess Snow Crab stocks in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 2HJ3KLNO, Subdivision (Subdiv.) 3Ps, and Div. 4R, and to provide the most recent information available for whelk in Subdiv. 3Ps.

A Science Advisory Report (SAR) was written and reviewed in meetings from March 4-6, 2013. It includes overall and division-by-division summaries for crab, which were written and reviewed at the RAP meeting. Detailed rapporteur's notes of discussion on each working paper presented at the RAP, in question-and-answer/comment-and-response form, were produced. This Proceedings Report includes an abstract and summary of discussion for each working paper presented, and a list of research recommendations.

Compte rendu de l'examen par des pairs de l'évaluation du stock de crabes des neiges de Terre-Neuve-et-Labrador ; du 27 février au 6 mars 2013

SOMMAIRE

Une réunion du processus de consultation régionale (PCR) de Terre-Neuve-et-Labrador sur le crabe des neiges et le buccin a eu lieu du 27 février au 6 mars 2013 à St. John's, à Terre-Neuve-et-Labrador. Le but de cette réunion était d'évaluer les stocks de crabes des neiges dans la division 2HJ3KLNO, la sous-division 3Ps et la division 4R de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO) et de fournir les renseignements les plus récents au sujet du buccin pour la sous-division 3Ps.

Un avis scientifique (AS) a été rédigé et examiné lors de réunions qui ont eu lieu du 4 au 6 mars 2013. Cet avis comprenait des résumés des stocks de crabes (pour l'ensemble des divisions et propres à chaque division) qui ont été rédigés et examinés lors de la réunion sur le PCR. Les notes détaillées du rapporteur sur les discussions tenues pour chacun des documents de travail ont été présentées lors de la réunion sur le PCR, sous forme de questions-réponses/commentaires-réponses. Ce compte rendu comprend un résumé et un sommaire des discussions liées à chaque document de travail présenté, de même qu'une liste des recommandations relatives à la recherche.

INTRODUCTION

A meeting of the Newfoundland and Labrador RAP on Snow Crab (*Chionoecetes opilio*) and whelk was held from February 27-March 6, 2013 in St. John's, Newfoundland and Labrador (NL) to assess Snow Crab stocks in NAFO Divs. 2HJ3KLNOP4R and to provide the most recent information available for whelk in Subdiv. 3Ps. Terms of reference, the agenda, and lists of participants and working papers presented at the meeting are provided in Appendices I through IV, respectively.

Participation included personnel of Fisheries and Oceans Canada (DFO) Science and Fisheries Management Branches (Newfoundland and Labrador Region), representatives from the fishing industry, Provincial Department of Fisheries and Aquaculture, and Memorial University.

Open discussion and debate proceeded during and after each presentation. At the meeting, consensus was reached on summary bullets of results of the assessment for the overall and division-by-division summaries for Snow Crab. These are included in a SAR written and reviewed March 4-6, 2013. The most recent information available for whelk in Subdiv. 3Ps will also be provided in a SAR.

These proceedings contain abstracts for working papers presented and summaries of the discussion on each. Additional information can be found in the SAR and in research documents cited or from contacts provided therein.

WORKING PAPER ABSTRACTS AND DISCUSSION SUMMARIES

CLIMATE CONDITIONS IN THE NORTHWEST ATLANTIC DURING 2012, NL REGION

E. Colbourne, J. Craig, C. Fitzpatrick, D. Senciall, P. Stead, and W. Bailey.

Presenter – E. Colbourne

Abstract

The North Atlantic Oscillation index, a key indicator of climate conditions on the Newfoundland and Labrador Shelf, after being in the negative phase for two consecutive years increased to 1.3 Standard Deviations (SD) above normal in 2012, the highest since 1989. As a result, arctic air outflow to the Northwest Atlantic during the winter increased over the previous year causing a significant decrease in winter air temperatures over much of the Labrador Sea area. Annual air temperatures however remained above normal at Labrador by 1.4 SD (1.8°C at Cartwright) and Newfoundland by 2.3 SD (1.9°C at St. John's). The annual sea ice extent on the NL Shelf remained below normal (0.7 SD) for the 17th consecutive year, an increase of 1 SD over the record low in 2011. As a result of these and other factors, local water temperatures on the Newfoundland and Labrador Shelf remained above normal in most areas but decreased significantly over 2011 values. Salinities on the NL Shelf were lower than normal throughout most of the 1990s, increased to above normal during most of the past decade but decreased to fresher-than-normal conditions in many areas from 2009-12. At a standard monitoring site off eastern Newfoundland (Station 27), the depth-averaged annual water temperature decreased to 1 SD (0.4°C) above normal from the record high of 3 SD (1°C) in 2011. Annual surface temperatures at Station 27 increased to 1.5 SD (1 °C) above normal while bottom temperatures (176 m) decreased to 1.1 SD (0.4 °C) down from the record high of 3.4 SD (1.3°C) in 2011. The annual depth-averaged salinities at Station 27 were below normal for the 4th consecutive year. The area of the cold intermediate layer (CIL) water mass with temperatures < 0°C on the eastern Newfoundland Shelf (Bonavista Section) during 2012 increased to 0.5 SD below normal

from the record low value at 2 SD below normal in 2011, implying a continuation of warm conditions, while off southern Labrador it was the 0.5 SD below normal. On the Grand Bank the CIL was about normal during the summer of 2012. Spring bottom temperatures in Subdiv. 3Ps and Div. 3LNO during 2012 were above normal by an average of about 1°C a moderate decrease over 2011 conditions. During the fall, bottom temperatures in Div. 2J, Div. 3K and Div. LNO decreased from 2, 2.7 and 1.8 SD above normal in 2011 to 1.1, 1.2 and 0.2 SD above normal in 2012 respectively, a significant decrease. The volume of CIL ($< 0^{\circ}\text{C}$) water on the NL shelf during the fall was close to normal. A composite climate index derived from 27 meteorological, ice and ocean temperature and salinity time series show a peak in 2006, a declining trend in 2007-09 and a sharp increase in 2010 and 2011 to the 2nd and 4th highest respectively, indicating warmer than normal conditions throughout the region. In 2012 it decreased to the 8th highest in the 63 year time series.

Discussion

Because of year-to-year variation in temperature, interpretations based on short-term trends should be avoided. Instead, long-term trajectories of the temperature and habitat indices are used. The evidence suggests an overall warming, with the northern areas warming faster than the southern areas. Since colder waters are better for Snow Crab, this suggests that long-term recruitment prospects are not favourable.

OCEAN PRODUCTIVITY TRENDS ON THE NEWFOUNDLAND AND LABRADOR SHELVES

G. Maillet, P. Pepin, and E. Colbourne.

Presenter – G. Maillet

Abstract

Bi-monthly ocean colour imagery and oceanographic data indicate a decline in standing stocks of marine phytoplankton (primary producers) across the Newfoundland and Labrador Shelves in 2012. Timing indices of the spring bloom suggest a trend toward earlier and shorter production cycles. Indices of primary and secondary production from seasonal oceanographic surveys have remained relatively stable over the past decade and in some cases have trended upwards (e.g. copepod abundance) that may support feeding of early life stages of Snow Crab. Long-term changes in primary and secondary producers based on the Continuous Plankton Recorder indicate increased standing stocks of phytoplankton and zooplankton during the 2000's and recent years although certain cold-water-adapted calanoids (*Calanus hyperboreus*) and macro-zooplankton such as Euphausiids have declined on the southern and northern Newfoundland Shelf.

Discussion

Continuous Plankton Recorder data collected during this survey could provide information on shellfish larval abundance on the Newfoundland and Southern Shelves, but the dataset was unavailable at the time of this meeting.

Subdivision 3Ps had the greatest duration and magnitude of production in 2012. The composite information examines both amplitude and magnitude of the bloom, and it is unclear as to which of these components is contributing to the large increase in 2012 values. Despite a lack of consistency across areas, some areas, such as Div. 4R and Subdiv. 3Pn, exhibited a large change in some aspect of production in 2012 (for example, a large increase in the duration of the bloom). The scale of analysis may be contributing to the lack of consistency in these patterns across regions.

The correlation between the satellite near surface temperature (SST) time series and the ocean colour time series has been explored. In some cases SST explains some of the variance in the ocean colour time series, but the proportion of the variance explained is low. For an in-depth analysis other factors that regulate primary production, such as nutrient dynamics, light, solar radiation, and the depth of the mixed layer, need to be examined.

UPDATE ON TRENDS IN THE FISH COMMUNITY AND DIET OF KEY GROUNDFISH SPECIES IN THE NEWFOUNDLAND-LABRADOR ECOSYSTEM

M. Koen-Alonso and N. Wells

Presenter – N. Wells

Abstract

The Newfoundland-Labrador marine ecosystem (NAFO Divs. 2HJ3KLNO) can be described in terms of two major subsystems: the Labrador-northern Newfoundland shelf (2HJ3KL) in the north, and the Grand Bank proper (NAFO Divs. 3LNO) in the south, where the northern Grand Bank region (schematically defined as NAFO Div. 3L) functions as a transition/overlap zone between these major subsystems.

During the late 1980s and early 1990s most of the fish communities in the Newfoundland and Labrador shelves marine ecosystem collapsed; the exceptions were small benthivore fish and especially shellfish, whose biomass increased significantly. Even though this collapse is often associated primarily with Atlantic cod in the early 1990s, declines in several functional groups started in the early 1980s. The collapse was observed throughout the system and involved commercial and non-commercial species alike. Current levels of some fish functional groups are still well below pre-collapse levels. Shellfish (dominated by shrimp) has declined significantly since 2007; its current biomass level in 2J3KL is similar to the one observed in 1995-97. Snow crab biomass declined in the late 1990s and, even though it showed some build-up in the northern region (2J3KL) during the late 2000s, the trend in this area has been a declining one since 2009. In the northern Grand Bank there seems to be a mild positive trend since the lowest values observed in the mid-2000s.

The diet of five key groundfish species was studied through the examination of stomach contents. In the mid-1990s, the contribution of capelin to the diet of fish predators was reduced, while that of shrimp increased. Diets of some fish predators on the Grand Bank have been dominated by sand lance in recent years. For smaller/younger predators, amphipods are an important prey. The importance of snow crab in the diet of cod showed a moderate increase in 2011. This increase seems to be driven by large cod (> 65 cm) eating snow crab in 3K.

Discussion

There is a study currently underway that will produce consumption estimates for five groundfish species, as well as examine environmental effects such as temperature. The consumption of Snow Crab by Atlantic Cod (*Gadus morhua*) is dependent on the availability of other prey species, such as Capelin (*Mallotus villosus*) and shrimp (*Pandalus* sp.). Atlantic Cod are generally thought to be opportunistic feeders, and variations in their diet over time and across areas have been observed. A recent study however, suggests that cod may be more selective than previously thought. In comparing the northern Gulf of St. Lawrence and the Newfoundland shelves, Atlantic Cod on the Newfoundland Shelf switched heavily from Capelin to shrimp while Greenland Halibut (turbot; *Reinhardtius hippoglossoides*) did not. In the northern Gulf of St. Lawrence, Greenland Halibut switched from Capelin to shrimp while Atlantic Cod did not, despite alternative prey availability.

AN ASSESSMENT OF NEWFOUNDLAND AND LABRADOR SNOW CRAB (*CHIONOECETES OPILIO*) IN 2012:

Overview of Divisions 2HJ3KLNOP4R

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenters – E. Dawe and D. Mullowney

Abstract

Resource status was evaluated throughout Div. 2HJ3KLNOP4R based on trends in biomass, recruitment and mortality. Multiple indices of these metrics were derived from a suite of data sources that include dockside-monitored landings, harvester logbooks, at-sea observer monitoring, pre-and post-season trawl surveys, broad-scale post-season trap surveys, localized inshore trap surveys, a vessel monitoring system (VMS), and biological sampling data from multiple sources. The resource was assessed separately for offshore and inshore areas of each NAFO Division, where appropriate (Div. 3KLP4R). Data availability varied among Divisions and between inshore and offshore areas within Divisions. The multi-species trawl surveys indicate that the exploitable biomass declined from 2009 to 2011 but was unchanged in 2012. The trawl surveys indicate that recruitment has recently declined and is expected to decline further in the short term (2-3 years). Longer-term recruitment prospects are unfavourable due to a recent warm oceanographic regime. Trends in indices are described in detail for each Division and conclusions are presented with respect to the anticipated effects of short-term changes in removal levels on fishery induced mortality.

Discussion

There are consistent links between ocean climate variability and Snow Crab abundance. Ocean climate effects are thought to be the dominant influence on the observed decreases in overall Snow Crab abundance, and mature female abundance. Harvesting will likely have less of an impact on abundance relative to ocean climate effects, but it will increase the rate of decline.

Overview of Divisions 2HJ

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – D. Mullowney

Abstract

Landings decreased by 37% since 2008 to 1,600 tonnes (t). Meanwhile effort increased by 55% to 2011 before decreasing by 23% in 2012. The total allowable catch (TAC) has not been taken in the past 2 years. Catch per unit effort (CPUE) most recently peaked in 2008, then declined steadily by half to 2011, and was unchanged in 2012. The exploitable biomass, as indicated by the post-season trawl survey, declined steadily from 2006 to 2011 and was unchanged in 2012. Recruitment declined from 2006 to 2011, changed little in 2012, and is expected to remain low in the short term (2-3 years). The post-season trawl survey pre-recruit index decreased sharply in 2005 and has since fluctuated without trend. Long-term recruitment prospects are unfavourable due to a recent warm oceanographic regime. The exploitation rate index has increased steadily after 2007 to its highest level since 2004. The pre-recruit fishing mortality rate index has been at its highest level since 2004 during each of the past two years. The percentage of the catch handled and released in the fishery increased from about 10% in 2008 to about 35% in 2012 implying a potential increase in pre-recruit mortality. Maintaining the

current level of fishery removals would likely result in little change in the exploitation rate in 2013 but would likely result in high mortality on soft-shelled immediate pre-recruits.

Discussion

The fishery data based on logbooks were incomplete for 2012, with logbook landings of only 1000 t reported due to uncollected logbooks.

It was suggested that if the decline in the stock is due to ocean climate variability, then reducing quotas may not help. It was explained that both ocean climate and fishing contribute to the decline. There is an inverse relationship between CPUE and bottom temperature some years earlier. Recent low temperatures are still high relative to historical temperatures, suggesting that without fishing the stock would likely decline. Fishing will hasten the decline. Fishing of soft-shelled crab will have a particularly large impact due to the discarding of animals with a high probability of dying. Without fishing, there would be an increase in residual biomass. Soft-shelled crabs do not trap as much when residual biomass is high, which would reduce the incidence of soft-shelled crab. It is unlikely that crabs migrate out from Div. 2J to more suitable temperatures and habitat.

Mean bottom temperatures are based on temperature data collected on a set-by-set basis. The habitat index is based on application of those temperature data across the entire survey area. Ocean climate indices are shown at a lag (6 years for Div. 2J) with CPUE so they relate to a stage that is believed to be critical. In these analyses, lags of 6-10 years typically give relatively good correlations, and always with a negative relationship with temperature and a positive relationship with area.

Since there were high numbers of soft-shelled crab in the observer data, higher numbers of new-shelled crab would be expected in the post-season survey. This did not seem to occur, suggesting high mortality of discarded soft-shelled crab.

In Div. 2J the majority of small crabs (< 40 mm carapace width, CW), male and female, were found in cold, shallow areas. The majority of large crab were found in the deeper Cartwright and Hopedale channels. An ontogenetic migration to deeper waters may occur when crabs become larger than about 35-45 mm CW.

Female abundance is showing a decline in recent years. There should be no fishery effect on the females, as they can escape the traps quite readily and must be released if caught. However, low catchability of females by the survey trawl adds uncertainty to the female abundance index. It was observed that ocean climate variability has the best relationship with mature female abundance at a lag of zero (unpublished data). A decline in females would then precede a decline in larger crab. The female index is consistent across all areas, showing a decline in female abundance with little change in the percentage of mature females with full clutches of viable eggs.

When biomass declines in Div. 2J, the resource becomes concentrated.

Overview of Division 3K Offshore

D. Mullooney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – E. Dawe

Abstract

Landings peaked at 12,600 t in 2009 but decreased by 52% to 6,000 t in 2012. The TAC was not achieved in the past three years. Effort peaked in 2009 and has since declined by 31%. CPUE declined by half from 2008 to 2011 and changed little in 2012. The exploitable biomass,

as indicated by the post-season trap and trawl surveys, declined by more than half from 2008 to 2011 and was unchanged in 2012. Recruitment declined after 2008 and prospects remain poor in the short term (2-3 years). Post-season pre-recruit biomass indices from both trap and trawl surveys have decreased by about 55% after 2008. Long-term recruitment prospects are unfavourable due to a recent warm oceanographic regime. The trawl survey-based exploitation rate index increased sharply from 2008 to 2010 and changed little in 2011 before decreasing in 2012. The pre-recruit fishing mortality rate index increased from 2007 to 2011 but decreased in 2012. The percentage of the catch handled and released in the fishery increased from about 7% in 2008 to about 20% in 2012 implying a potential increase in pre-recruit mortality. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate but would likely result in high mortality on soft-shelled immediate pre-recruits in 2013.

Discussion

Predictions from recruitment signals should be made with caution, as they could be an artefact of trawl catchability. Caution should also be used when drawing conclusions from the plot of CPUE on cumulative catch due to an incomplete dataset in 2012.

Including Crab Management Areas (CMA) 3BC and 3A in the offshore for evaluation of the resource makes the fishery data more comparable to the offshore trawl survey data. The consultation will have all the information for each of the CMAs in Div. 3K.

Observer, logbook, and VMS data all showed a decline in CPUE by half from 2008 to 2011, with little change in 2012.

A debate occurred on the use of the percentage of catch released as a measure of mortality. One side argued that mortality is high on handled and released crab, especially soft-shelled immediate pre-recruits. The other side argued that mortality of handled and released crab might not be high, since harvesters now pick on deck. It was suggested that mortality is dependent on the shell condition of stage of pre-recruit crabs and level of fishing effort.

It was felt that the soft-shelled protocol will not be effective in 2013 because of very low observer coverage. There is concern that if the soft-shelled protocol is not improved, harvesters may put more pressure on soft-shelled crabs when catches are low, since increased effort leads to more handling of soft-shelled crabs. Observer sample sizes are often too low to implement the current soft-shelled protocol.

A harvester brought up concerns regarding "carry-over quotas". It was explained that a harvester who was unable to catch his approved quota in 2012 was granted permission to carry half of that quota over into this year, in addition his new 2013 quota. It was asked how these quotas would affect science. The general consensus was that nobody present at the meeting was aware this decision and it was not discussed further.

With trends in the Snow Crab resources generally showing decline, there are concerns about future larval supply.

Overview of Division 3K Inshore

D. Mullaney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – E. Dawe

Abstract

Landings increased from 2,200 t in 2005 to 2,900 t in 2009, but decreased by 34% to 1,900 t in 2012. The TAC was not taken in the past four years in two of the three CMAs. Effort increased by 70% from 2008 to 2011 before decreasing by 19% in 2012. CPUE increased sharply from

2005 to a record high level in 2008, and then declined by more than half before increasing slightly in 2012. The exploitable biomass, as indicated by the post-season trap survey, decreased from 2007 to 2009 and since changed little but there is considerable variability among management areas. While uncertain, recruitment prospects appear to have changed little and there is considerable variability among management areas. The trap survey-based exploitation rate index changed little between 2011 and 2012. Data are insufficient to estimate the pre-recruit fishing mortality rate index. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate in 2013. However, it would likely result in high mortality on soft-shelled immediate pre-recruits in some management areas in 2013.

Discussion

The exploitation rate index is calculated by dividing landings by the biomass index from the previous year. The exploitable rate index increased sharply for White Bay (CMA 3B) in 2012, but it was felt that was due to an anomalously low 2011 biomass index, a function of traps not fishing properly in the survey that year. Soak time effects were also investigated, but were not significant (Mullowney, unpublished data).-

Overview of Division 3LNO Offshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – E. Dawe

Abstract

Landings decreased by 11% from 24,500 t in 2006 to 21,900 t in 2009 but since increased by 20% to 26,200 t in 2012. Effort increased by 80% from 2000 to 2008 and has since declined by 23%. VMS-based CPUE declined to its lowest level in 2008, but has since increased steadily to above the average of the series. The trawl survey index of exploitable biomass declined from 2009 to 2011 and changed little in 2012. The index from the trap survey, which tends to capture older-shelled crabs relatively better than new-shelled crabs in this area, peaked two years later in 2011 and changed little in 2012. Recruitment has recently peaked and will likely decrease in the short term (2-3 years). Long-term recruitment prospects are unfavourable due to a recent warm oceanographic regime. The exploitation rate index increased during the past two years following a sharp decrease from 2008 to 2010. The pre-recruit fishing mortality rate index decreased from 2008 to 2011 but increased in 2012. The percentage of the catch handled and released in the fishery decreased from about 20% in 2008 to 12% in 2012, implying a potential decrease in pre-recruit mortality. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate in 2013.

Discussion

There was a large decrease in abundance of mature females since 2009, as well as in the percentage with full clutch since 2010. This is likely caused by a warming ocean climate. It was also suggested that the decreases could be due to trawl selectivity. It was explained that if the trawl was the factor, then no consistent relationship should exist with ocean climate variability. Another confounding factor is that females are known to have a patchy distribution relative to the more random distribution of males, which could lead to inconsistent results.

Pre-recruit and exploitable biomass indices correlate best at a lag of zero. This is attributed to annual changes in survey trawl efficiency or 'year effects'. Merging of cohorts due to skip moulting also plays a role. Skip moulting frequency increases with temperature and body size, so in cold areas merging cohorts will have more of an affect than in warmer areas.

There has been no indication of high levels of soft-shelled crab in Div. 3LNO in recent years, but there have been reports of pockets of soft shell in deeper waters and along the slope later in the year. It was suggested that mapping the spatial distribution of soft-shelled crabs could help harvesters avoid soft shell areas.

In the last 3-4 years, harvesters in Div. 3LNO offshore have experienced increases in catch and a decrease in effort, suggesting a healthy biomass. In contrast, the trawl survey indicates a decline in exploitable biomass. The issue is that there are differences in selectivity between the surveys, with the trawl survey catching new-shelled crabs relatively better than do the trap surveys. The decision was made to describe the trends of the trap and trawl indices independently.

Overview of Division 3L Inshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – D. Mullowney

Abstract

Landings increased by 19% from 6,100 t in 2005 to 7,300 t in 2010, and have since changed little, at 7,400 t in 2012. Effort increased by 24% from 2008 to 2010 but has since declined by 22%. Catch per unit effort increased sharply in 2012 to its highest level since 1995, after varying about the long term average for the previous five years. The post-season trap survey index suggests that the exploitable biomass increased in 2012 to its highest level in the time series. Recruitment has recently peaked and is in decline, although there is considerable variability among management areas. Short-term (2-3 years) prospects are uncertain. The trap survey-based exploitation rate index changed little in 2012 but there was considerable variability among management areas. Data are insufficient to estimate a pre-recruit fishing mortality rate index. Maintaining the current level of fishery removals would likely result in a decrease in the exploitation rate in 2013.

Discussion

Harvesters observed larger crabs and fewer females in deeper water. Smaller crabs may not trap as well due to competition with larger crabs.

Trawl catchability (with no gear change) appears to be higher using the new research vessel (Vladykov) than using the Shamook. This implies that a new time series will have to be started for trawl data. Trinity Bay, and St. Mary's Bay may also be considered for surveys in the future. There are also plans to expand trap surveys to better cover the full depth range to give a more complete picture of the entire distribution. Harvesters request that they be consulted prior to any changes to survey plans.

Overview of Subdivision 3Ps Offshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – D. Mullowney

Abstract

Landings almost doubled from 2,300 t in 2006 to a peak of 4,300 t in 2011, before decreasing by 14% to 3,700 t in 2012. Effort increased by 57% from 2008 to 2011 before decreasing slightly in 2012. Catch per unit effort increased from 2005 to 2009 and has gradually declined since. The exploitable biomass, as indicated by both the spring trawl survey and the post-season trap

survey indices, increased steadily from 2006 to 2009 before declining sharply from 2009 to 2011 and changed little in 2012. Recruitment has recently declined and is expected to decline further in the short term (2-3 years). Pre-recruit biomass indices from both trap and trawl surveys declined sharply from 2009 to 2011 and changed little in 2012. Long-term recruitment prospects are unfavourable due to a recent warm oceanographic regime. Exploitation and pre-recruit fishing mortality rates, as indicated by spring trawl survey indices, decreased from 2007 to 2009 but increased sharply to 2011 and changed little in 2012. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate in 2013.

Discussion

It is possible that 'new hard-shell' and 'soft-shell' classes of the post-season trap survey contain crabs that were terminally-molted, even though they are used as an index of recruitment.

It was noted that small-meshed traps were only used offshore in CMA 11S. Therefore, the adolescent signal for 2012 may not be representative of the entire area. It was also noted that Subdiv. 3Ps offshore is cold relative to Div. 3K and Div. 3J.

There were additional data presented from St. Pierre et Miquelon (Data provided by Martial Laurans, IFREMER). Landings there slightly increased in 2012. CPUE peaked in 2010, with a slight decrease in 2011-12.

The spatial distribution of the resource in Subdiv. 3Ps offshore may have shifted or contracted. It was pointed out that the spring trawl survey occurs during the fishery, not before it. With the likelihood that much of the catch is taken early in the fishery, the spring trawl survey may be closer to a post-season survey than a pre-season survey.

Overview of Subdivision 3Ps Inshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – E. Dawe

Abstract

Landings peaked at 3,500 t in 1999, declined to 700 t in 2005, then more than tripled to 2,500 t in 2012. Effort declined from 2005 to 2010 and increased by 36% to 2012. Catch per unit effort increased steadily from 2005 to 2010, its highest level since 1996, and has since changed little. The exploitable biomass, as indicated by the post-season trap survey index, increased substantially between 2006 and 2010 and has since changed little. Recruitment has recently decreased. The index of pre-recruit-sized males has recently decreased, suggesting a further decline in recruitment in the short term (2-3 years). The post-season trap survey-based exploitation rate index changed little during 2008 to 2011 but increased in 2012. Data are insufficient to estimate a pre-recruit fishing mortality rate index. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate in 2013.

Discussion

In the post-season trap survey, soak times are much different between Subdiv. 3Ps inshore and offshore, yet comparisons are made between the areas. It was also noted that soak times were shorter in 2012 relative to 2011, which would lead to inflated biomass estimates in 2012.

Landings data for CMA 11E (Fortune Bay) from 2004-09 came from a monitoring fishery, since there was a moratorium in place during that period.

Subdiv. 3Ps offshore recruitment indices contain more uncertainty than in most other regions because males terminally molt at especially small size in this cold area. This terminally molting at a small size could have a large effect on recruitment.

A harvester expressed concern with CMA 11 being included in the region, since the majority of crab are caught outside of 12 miles.

Overview of Division 4R Offshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – D. Mullowney

Abstract

Landings declined by 83% from 190 t in 2007 to a historical low of 30 t in 2010, but increased back to 190 t in 2012. Effort increased by a factor of four in 2011 following the historical low in 2010 and changed little in 2012. The TAC has not been taken since 2002. Vessel monitoring system-based CPUE declined from 2004 to its lowest level in 2009 before increasing to the average of the series in 2012. The exploitable biomass remains low relative to other areas. Recruitment prospects are uncertain in the short term (2-3 years). Long term recruitment prospects are unfavourable due to a recent warm oceanographic regime. Data are insufficient to calculate the exploitation rate and pre-recruit fishing mortality rate indices. The effect of maintaining the current level of removals on the exploitation rate in 2013 is unknown.

Discussion

Biomass trends of trap and trawl surveys track well together, with only 2009 not in agreement. Trawl surveys also seem to precede the trends of CPUE lagged one year. The trawl survey pre-recruit and exploitable biomass indices trend together, suggesting strong year effects. Therefore caution should be used in interpreting the recruitment index. There is additional uncertainty in the trawl survey pre-recruit index because chelae are not measured in this survey. It was argued that the trends in the trawl survey biomass do not actually track well with trends in CPUE one year later. After much discussion, it was concluded that the pattern is only consistent over the past two years. The spatial distribution of the fishery has also changed in recent years, adding even more uncertainty.

A concern was raised regarding the description of trends and reliance on indices with very low sample sizes. It was pointed out that other assessments have been done with much poorer data, and that the interpretation of survey results are carried out despite low sample sizes so that comparisons can be made to other areas.

Snow Crab are known to migrate to deeper waters with age. In Div. 4R, smaller crabs are typically found in shallower areas, while larger crabs are found in the deeper waters in the northern offshore area.

It was noted that some of the biomass in Div. 4R offshore could be described as spill-over from the inshore. It was suggested that since data from Div. 4R offshore is poor and spill-over is likely occurring from the inshore, it may be more beneficial to assess the inshore and offshore together in the future.

Overview of Division 4R Inshore

D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons

Presenter – D. Mullowney

Abstract

Landings declined by 80% from 950 t in 2003 to a historical low of 190 t in 2010. They more than doubled to 450 t in 2011 and increased further to 55 t in 2012. Effort declined by 95% from 2004 to 2010 and doubled in 2011 before decreasing substantially in 2012. The TAC has not been taken since 2002. Catch per unit effort declined by more than half from 2002 to 2007 and changed little to 2010 before more than doubling to 2012. The exploitable biomass, as indicated by the post-season trap survey, fluctuated at a low level from 2006 to 2010 but tripled in 2011 and changed little in 2012. Recruitment has recently increased and is expected to remain strong in 2013, but short-term (2-3 years) prospects are unfavourable. The post-season trap survey-based exploitation rate index decreased sharply in 2012. Data are insufficient to estimate a pre-recruit fishing mortality rate index. Maintaining the current level of fishery removals would likely result in little change in the exploitation rate in 2013.

Discussion

In CMA 13, which shares a border with Div. 4R, tagging near Port au Choix revealed a migration into deeper waters, which supports the pattern observed in Div. 4R inshore.

ANOTHER LOOK AT MATURE FEMALE SNOW CRAB

K. Skanes

Presenter – E. Dawe

Abstract

A comparison of trends in the trawl survey abundance index of mature females indicated that abundance has declined in recent years in all offshore areas to the lowest level in the survey series in 2011 or 2012. The percentage of mature females bearing full clutches of viable eggs was decreased sharply (to about 60%) in Div. 3LNO in 2011-12. This percentage remained high (about 90%) in the northern areas (Div. 2HJ and 3K)

Discussion

The recent sharp decline in mature female abundance was attributed to the adverse effect of the warming ocean climate. While this decline is cause for concern, it is unknown at what level larval supply may become a limiting factor to snow crab productivity and subsequent recruitment.

THE SAR FOR WHELK

Presenter – D. Maddock-Parsons

The 2012 draft SAR for the Common Northern or Waved Whelk (*Buccinum undatum*) was made available to the participants to read, review and discuss at the meeting.

Discussion

There has been no formal assessment for whelk in this region. The only science management has requested is background on size at maturity in order to set a TAC. Most of the other available information comes from other areas of Canada. The current TAC (5,000 t) is based on

little science, and the general consensus is that more scientific analysis is required for whelk. It was suggested that interested parties contact the management division to proceed with concerns on whelk.

RESEARCH RECOMMENDATIONS

1. Compare trawl survey and trap survey swept-area Snow Crab biomass estimates by shell category (new-shelled and old-shelled) to address the hypothesis that the trawl survey captures new-shelled crabs more efficiently than does the trap survey. Consider selecting sets from the common geographical areas for this comparison.
2. Evaluate the spatial and temporal trends of larval decapod abundance from the Continuous Plankton Recorder program to infer the inter-annual trends in the northwest Atlantic.
3. Develop and document an understanding of the reasoning that underlies Snow Crab assessment:
 - (i) what people want to know;
 - (ii) what we believe or are prepared to assume (about crab populations and how they change, and about methods of sampling them);
 - (iii) what is measured; and,
 - (iv) what inferences one can legitimately and usefully draw from the above.

Recommendation of mature female research.

4. Compare trends in abundance of mature female Snow Crab with those in comparably-sized males, toward inferring whether trends reflect reality or an artifact of survey catchability.
5. Develop precautionary reference points for Snow Crab for major management units.

APPENDIX I: TERMS OF REFERENCE

Newfoundland and Labrador Snow Crab Assessment

Regional Peer Review Process - Newfoundland and Labrador Region

February 27 - March 1, 2013

St. John's, NL

March 4-6, 2013 [¹]

St. John's, NL

Chairperson: Dawn Maddock-Parsons

Context

The status of Div. 2HJ3KLNO, Subdiv. 3Ps, and Div. 4R Snow Crab was assessed in 2012. The current assessment of these stock components is requested by Fisheries Management to provide current information on the status of the resource and provide the data that will be used in the 2013 Snow Crab Management Plan.

Information on whelk in Subdiv. 3Ps, with emphasis on the size at which sexually maturity is achieved, was updated and reviewed in 2012. That most recent information will be tabled as a draft Science Advisory Report (SAR).

Objectives

- To assess the status of the Snow Crab resource: Divisions 2HJ3KLNO4R;
- To determine the impact of maintaining the current harvest levels;
- To provide the most recent information available for whelk in Subdiv. 3Ps (from the 2012 regional peer review).

Expected publications

- Two Science Advisory Reports
- Proceedings
- Research Documents

Participation

- Fisheries and Oceans Canada (DFO) experts (Science, and Fisheries Management)
- Province of Newfoundland and Labrador Department of Fisheries and Aquaculture
- Academia
- First Nations
- Fishing Industry
- Other invited experts

[¹] March 4-6 will be used to finalize the complete text of the Science Advisory Reports. All attendees are invited to participate. Summary bullets for each stock will be agreed upon in plenary during the February 27 – March 1, 2013 meeting.

APPENDIX II: AGENDA

Newfoundland and Labrador Regional Peer Review Meeting: Assessment of Snow Crab

Holiday Inn
St. John's, Newfoundland & Labrador

February 27- March 1, 2013

Northwest Atlantic Fisheries Centre, 80 East White Hills Road
St. John's, Newfoundland & Labrador

March 4-6, 2013

Chair: Dawn Maddock-Parsons

Wednesday, February 27

Time	Topic	Presenter
0900	Preliminaries and greetings from the Chair	Dawn Maddock-Parsons
0930	Oceanographic Overview	Eugene Colbourne
1000	Trends in Ocean Productivity	Gary Maillet
1030	<i>BREAK</i>	
1045	Update on Trends in the Fish Community and Diet of Key Groundfish Species in the Newfoundland-Labrador Ecosystem	Nadine Wells
1115	Divisions 2HJ3KLNOP4R Overview and Science Advisory Report Bullets	Earl Dawe
1200	<i>LUNCH</i>	
1300	Division 2HJ and Science Advisory Report Bullets	Darrell Mallowney
1400	Division 3K Offshore	Earl Dawe
1500	<i>BREAK</i>	
1515	Division 3K Offshore Science Advisory Bullets	Earl Dawe
1700	<i>ADJOURN</i>	

Thursday, February 28

Time	Topic	Presenter
0900	Division 3K Inshore and Science Advisory Report Bullets	Earl Dawe
1030	<i>BREAK</i>	
1045	Division 3LNO Offshore	Earl Dawe
1200	<i>LUNCH</i>	
1300	Division 3LNO Offshore Science Advisory Report Bullets	Earl Dawe
1430	Division 3L Inshore and Science Advisory Report Bullets	Darrell Mullowney
1500	<i>BREAK</i>	
1515	Division 3L Inshore and Science Advisory Report Bullets (continued)	Darrell Mullowney
1700	<i>ADJOURN</i>	

Friday, March 1

Time	Topic	Presenter
0900	Subdivision 3Ps Offshore and Science Advisory Report Bullets	Darrell Mullowney
1030	<i>BREAK</i>	
1045	Subdivision 3Ps Inshore	Earl Dawe
1200	<i>LUNCH</i>	
1300	Sub-division 3Ps Inshore Science Advisory Report Bullets	Earl Dawe
1400	Division 4R Offshore and Science Advisory Report Bullets	Darrell Mullowney
1500	<i>BREAK</i>	
1515	Division 4R Inshore and Science Advisory Report Bullets	Darrell Mullowney
1630	Research Recommendations	
1700	<i>ADJOURN</i>	

Monday-Wednesday, March 4-6: Writing of the Science Advisory Report (SAR) at Northwest Atlantic Fisheries Centre, 80 East White Hills Road in EPS Boardroom.

APPENDIX III: LIST OF PARTICIPANTS

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APPENDIX IV: LIST OF WORKING PAPERS PRESENTED

- An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf during 2012 by E. B. Colbourne, J. Craig, C. Fitzpatrick, D. Senciall, P. Stead, and W. Bailey.
- Ocean Productivity Trends on the Newfoundland and Labrador Shelves by G. Maillet, P. Pepin, and E. Colbourne.
- Update on Trends in the Fish Community and Diet of Key Groundfish Species in the Newfoundland-Labrador Ecosystem by M. Koen-Alonso and N. Wells
- An Assessment of Newfoundland and Labrador Snow Crab (*Chionoecetes opilio*) in 2012 by D. Mullowney, E. Dawe, K. Skanes, E. Hynick, W. Coffey, P. O'Keefe, D. Fiander, D. Stansbury, E. Colbourne, and D. Maddock-Parsons.